

8. *Lithobius Saussurei*, n. sp.

Lamina cephalica obcordata, fere æque longa ac lata, lateribus semicirculariter rotundatis, lævis, pilis sparsis vestita. *Antennæ* sat longæ, corporis dimidiam longitudinem haud assequentes, articulis 27 parce setosis, ultimo penultimum longitudine haud multo superante, compositæ. *Oculi* ——. *Coxæ* pedum maxillarum secundi paris dentibus 5+5 nigerrimis, brevibus, validis armatæ, sinu mediano subprofundo. *Scuta dorsualia* anteriora levius, posteriora manifestius rugulosa, at non granulata, subglabra, 9^{um}, 11^{um}, 13^{um} angulis productis, 7^{um} margine postico medio profunde sinuato. *Pori coxales* 5, 6, 7, 6 magni, subrotundi. *Pedes* primi paris calcaribus 2, 3, 2. *Pedum analium* articulus primus calcari singulo, laterali armatus. *Pedes anales* breves, sat inflati, unguibus binis, calcaribus 1, 3, 3, 1 armati. *Unguis genitalium* femineorum obsolete trilobus, lobo mediano laterales haud multo superante; calcarium duo paria. *Color* castaneus vel brunneus.

Longitudo corporis 23 millim., antennarum 9 millim., pedum analium 6-7 millim.

Hab. in Mexico circa urbem Orizaba (*H. de Saussure*). Unum tantum specimen (♀) vidimus.

Upsala, February 10, 1875.

XXV.—*Do Varieties wear out, or tend to wear out?*

By Professor ASA GRAY*.

THIS question has been argued from time to time for more than half a century, and is far from being settled yet. Indeed it is not to be settled either way so easily as is sometimes thought. The result of a prolonged and rather lively discussion of the topic about forty years ago in England, in which Lindley bore a leading part on the negative side, was, if we rightly remember, that the nays had the best of the argument. The deniers could fairly well explain away the facts adduced by the other side, and evade the force of the reasons then assigned to prove that varieties were bound to die out in the course of time. But if the case were fully reargued now, it is by no means certain that the nays would win it. The most they could expect would be the Scotch verdict, "not proven,"—and this not because much, if any, additional evidence of the actual wearing out of any variety has turned up since, but because a

* From Silliman's 'American Journal,' February 1875.

presumption has been raised under which the evidence would take a bias the other way. There is now in the minds of scientific men some reason to expect that certain varieties would die out in the long run; and this might have an important influence upon the interpretation of the facts that would be brought forward. Curiously enough, however, the recent discussions to which our attention has been called seem, on both sides, to have overlooked this matter.

But, first of all, the question needs to be more specifically stated if any good is to come from a discussion of it. There are varieties and varieties. They may, some of them, disappear or deteriorate, but yet not wear out—not come to an end from any inherent cause. One might even say, the younger they are the less the chance of survival unless well-cared for. They may be smothered out by the adverse force of superior numbers; they are even more likely to be bred out of existence by unprevented cross-fertilization, or to disappear from mere change of fashion. The question, however, is not so much about reversion to an ancestral state, or the falling off of a high-bred stock into an inferior condition. Of such cases it is enough to say that, when a variety or strain, of animal or vegetable, is led up to unusual fecundity, or size or product of any organ, for our good, and not for the good of the plant or animal itself, it can be kept so only by high feeding and exceptional care—and that with high feeding and artificial appliances come vastly increased liability to disease, which may practically annihilate the race. But then the race, like the burst boiler, could not be said to wear out; while if left to ordinary conditions, and allowed to degenerate back into a more natural, if less useful state, its hold on life would evidently be increased rather than diminished.

As to natural varieties or races under normal conditions, sexually propagated, it could readily be shown that they are neither more nor less likely to disappear from any inherent cause than the species from which they originated. Whether species wear out, *i. e.* have their rise, culmination, and decline from any inherent cause, is wholly a geological and very speculative problem, upon which, indeed, only vague conjectures can be offered. The matter actually under discussion concerns cultivated domesticated varieties only, and, as to plants, is covered by two questions.

First, *will races propagated by seed*, being so fixed that they come true to seed, and purely bred (not crossed with any other sort), continue so indefinitely, or *will they run out in time*—not die out, perhaps, but lose their distinguishing characters? Upon this, all we are able to say is that we know no reason why they

should wear out or deteriorate from any inherent cause. The transient existence or the deterioration and disappearance of many such races is sufficiently accounted for otherwise—as, in the case of extraordinarily exuberant varieties, such as mammoth fruits or roots, by increased liability to disease, already adverted to, or by the failure of the high feeding they demand. A common cause, in ordinary cases, is cross-breeding, through the agency of wind or insects, which is difficult to guard against. Or they go out of fashion and are superseded by others thought to be better; and so the old ones disappear.

Or, finally, they may revert to an ancestral form. As offspring tend to resemble grandparents almost as much as parents, and as a line of close-bred ancestry is generally prepotent, so newly originated varieties have always a tendency to reversion. This is pretty sure to show itself in some of the progeny of the earlier generations; and the breeder has to guard against it by rigid selection. But the older the variety is (that is, the longer the series of generations in which it has come true from seed), the less the chance of reversion: for, now, to be like the immediate parents is also to be like a long line of ancestry; and so all the influences concerned (that is, both parental and ancestral heritability) act in one and the same direction. So, since the older a race is the more reason it has to continue true, the presumption of the unlimited permanence of old races is very strong.

Of course the race itself may give off new varieties; but that is no interference with the vitality of the original stock. If some of the new varieties supplant the old, that will not be because the unvaried stock is worn out or decrepit with age, but because in wild nature the newer forms are better adapted to the surroundings, or, under man's care, better adapted to his wants or fancies.

The second question, and one upon which the discussion about the wearing-out of varieties generally turns, is, *Will varieties propagated from buds (i. e. by division), grafts, bulbs, tubers, and the like necessarily deteriorate and die out?* First, Do they die out as a matter of fact? Upon this the testimony has all along been conflicting. Andrew Knight was sure that they do; and there could hardly be a more trustworthy witness.

“The fact,” he says, fifty years ago, “that certain varieties of some species of fruit which have been long cultivated cannot now be made to grow in the same soils, and under the same mode of management which was a century ago so perfectly successful, is placed beyond the reach of controversy. Every experiment which seemed to afford the slightest pros-

pect of success was tried by myself and others to propagate the old varieties of the apple and pear which formerly constituted the orchards of Herefordshire, without a single healthy or efficient tree having been obtained; and, I believe, all attempts to propagate these varieties have, during some years, wholly ceased to be made."

To this it was replied, in that the next generation, that cultivated vines have been transmitted by perpetual division from the time of the Romans, and that several of the sorts, still prized and prolific, are well identified, among them the ancient *Græcula* (considered to be the modern Corinth or currant grape), which has immemorially been seedless, that the old nonpareil apple was known in the time of Queen Elizabeth, that the white *burré* pears of France have been propagated from the earliest times, and that golden pippins, St.-Michael pears, and others said to have run out were still to be had in good condition.

Coming down to the present year, a glance through the proceedings of pomological societies, and the debates of farmers' clubs, brings out the same difference of opinion. The testimony is nearly equally divided. Perhaps the larger number speak of the deterioration and failure of particular old sorts; but when the question turns on "wearing out," the positive evidence of vigorous trees and sound fruits is most telling. A little positive testimony outweighs a good deal of negative. This cannot readily be explained away, while the failures may be, by exhaustion of soil, incoming of disease, or alteration of climate or circumstances. On the other hand, it may be urged that, if a variety of this sort is fated to become decrepit and die out, it is not bound to die out all at once and everywhere at the same time. It would be expected first to give way wherever it is weakest, from whatever cause. This consideration has an important bearing upon the final question, Are old varieties of this kind on the way to die out on account of their age or any inherent limit of vitality?

Here, again, Mr. Knight took an extreme view. In his essay in the 'Philosophical Transactions,' published in the year 1810, he propounded the theory, not merely of a natural limit to varieties from grafts and cuttings, but even that they would not survive the natural term of the life of the seedling trees from which they were originally taken. Whatever may have been his view of the natural term of the life of a tree, and of a cutting being merely a part of the individual that produced it, there is no doubt that he laid himself open to the effective replies which were made from all sides at the time,

and have lost none of their force since. Weeping willows, bread-fruits, bananas, sugar-cane, tiger lilies, Jerusalem artichokes, and the like have been propagated for a long while in this way without evident decadence.

Moreover the analogy upon which his hypothesis is founded will not hold. Whether or not one adopts the present writer's conception, that individuality is not actually reached or maintained in the vegetable world, it is clear enough that a common plant or tree is not an individual in the sense that a horse or man, or any one of the higher animals, is—that it is an individual only in the sense that a branching zoophyte or mass of coral is. *Solvitur crescendo*: the tree and the branch equally demonstrate that they are not individuals, by being divided with impunity and advantage, with no loss of life, but much increase. It looks odd enough to see a writer like Mr. Sisley reproducing the old hypothesis in so bare a form as this—"I am prepared to maintain that varieties are individuals, and that as they are born they must die, like other individuals." "We know that oaks, sequoias, and other trees live several centuries; but how many, we do not exactly know. But that they must die, no one in his senses will dispute." Now what people in their senses do dispute is, not that the tree will die, but that other trees, established from cuttings of it, will die with it.

But does it follow from this that non-sexually propagated varieties are endowed with the same power of unlimited duration that are possessed by varieties and species propagated sexually (*i. e.* by seed)? Those who think so jump too soon at their conclusion. For, as to the facts, it is not enough to point out the diseases or the trouble in the soil or the atmosphere to which certain old fruits are succumbing, nor to prove that a parasitic fungus (*Peronospora infestans*) is what is the matter with potatoes. For how else would constitutional debility, if such there be, more naturally manifest itself than in such increased liability or diminished resistance to such attacks? And if you say that anyhow such varieties do not die of old age (meaning that each individual attacked does not die of old age, but of manifest disease), it may be asked in return, What individual man ever dies of old age in any other sense than of a similar inability to resist invasions which in earlier years would have produced no noticeable effect? Aged people die of a slight cold or a slight accident; but the inevitable weakness that attends old age is what makes these slight attacks fatal.

Finally, there is a philosophical argument which tells strongly for some limitations of the duration of non-sexually-

propagated forms, one that probably Knight never thought of, but which we should not have expected recent writers to overlook. When Mr. Darwin announced the principle that cross-fertilization between the individuals of a species is the plan of nature, and is practically so universal that it fairly sustains his inference that no hermaphrodite species continually self-fertilized would continue to exist, he made it clear to all who apprehend and receive the principle, that a series of plants propagated by buds only must have weaker hold of life than a series reproduced by seed. For the former is the closest possible kind of close breeding. Upon this ground such varieties may be expected ultimately to die out; but "the mills of the gods grind so exceedingly slow," that we cannot say that any particular grist has been actually ground out under human observation.

If it be asked how the asserted principle is proved or made probable, we can here merely say that the proof is wholly inferential. But the inference is drawn from such a vast array of facts that it is well nigh irresistible. It is the legitimate explanation of those arrangements in nature to secure cross-fertilization in the species, either constantly or occasionally, which are so general, so varied and diverse, and, we may add, so exquisite and wonderful, that, once propounded, we see that it must be true. What else, indeed, is the meaning and use of sexual reproduction? Not simply increase in numbers; for that is otherwise effectually provided for by budding propagation in plants and many of the lower animals. There are plants, indeed, of the lower sort, in which the whole multiplication takes place in this way, and with great rapidity. These also have sexual reproduction; but in it two old individuals are always destroyed to make a single new one! Here propagation diminishes the number of individuals 50 per cent. Who can suppose that such a costly process as this, and that all the exquisite arrangements for cross-fertilization in hermaphrodite plants, do not subserve some most important purpose? How and why the union of two organisms, or generally of two very minute portions of them, should reenforce vitality, we do not know and can hardly conjecture. But this must be the meaning of sexual reproduction.

The conclusion of the matter from the scientific point of view is, that sexually propagated varieties, or races, although liable to disappear through change, need not be expected to wear out, and there is no proof that they do—but that non-sexually propagated varieties, though not liable to change, may theoretically be expected to wear out, but to be a very long time about it.